

1908). Details and discussion of comparable observations extending over several years are given; they are believed to indicate that the sun's radiation changes in intensity from time to time, and that these alterations are sufficient to appreciably affect the temperature of the earth.

Miscellaneous.—Professor R. W. Wood has pointed out that the presence of radially polarised light in the solar corona does not necessarily indicate the scattering of sunlight by small particles. He has found that the fluorescent light emitted by comparatively cool metallic vapours is strongly polarised, even when the exciting light is unpolarised. With mixed vapours the integrated complex fluorescence spectra would appear practically continuous, as is the case with the corona. Professor Wood considers it possible that the green line and other lines observed in the coronal spectrum may be the fluorescent lines of well-known substances (*Ap. J.*, xxviii. 75).

Dr. Schuster points out that the renewed sun-spot activity in August was possibly connected with the 4·79-year period, which he has previously shown to have persisted since sun-spots were first systematically observed (*Nature*, lxxix. 7).

An account of some anomalous forms of the K line of calcium in prominences, with numerous illustrations, has been published by Belopolsky (*Mitt. Hauptsternwarte zu Pulkowo*, ii., No. 24).

From a discussion of photographs of the corona of 1905, the late Alexis Hansky considered it probable that the forms and directions of the streamers depended upon the prominences over which they appeared. Some streamers seemed to emanate from points near to, but not coincident with, spots (*Mitt. Hauptsternwarte zu Pulkowo*, ii., No. 19).

The second volume of the *Transactions* of the International Union for Solar Research has been issued (University Press, Manchester). A full account of the proceedings at the Meudon Conference of 1907 is given, together with reports of committees and a few original papers. Definitive values of the new wave-lengths of standard iron lines are given by Fabry and Buisson (also in *Ap. J.*, xxviii. 169).

A. F.

Double Stars.

The abbreviations used are—

M.N. : *Monthly Notices.*

A.N. : *Astronomische Nachrichten.*

L.O.B. : *Lick Observatory Bulletin.*

B.A.A. : *Journal of the British Astronomical Association.*

The number of measures published during the year is about the average:—E. D. Roe (6½-inch Clark), Syracuse, N.Y., gives a first contribution in *A.N.* 4259 of 47 pairs, ranging from 1"·0 to 53"·0 separation.

Professor Burnham (40-inch Clark), Yerkes, in *A.N.* 4261, has

measures of about 200 pairs, in continuation of those in *A.N.* 4209. These are mostly wide neglected pairs.

A fine series of measures of 150 pairs, mostly Struve, in *A.N.* 4279, is by H. E. Lau (10-inch), Copenhagen; and Dr. Küstner has some measures in No. 10 of the Bonn Observatory publications, *Katalog von 10665 sternern*.

The annual results of the measures made at the Royal Observatory, Greenwich, are in *M.N.*, May. There are about 380 pairs under 4" separation, made with the 28-inch Grubb refractor. Measures of wider pairs are not given.

Measures of southern pairs are contributed by Mr. Tebbutt in *M.N.*, March (8-inch, 13 pairs); by Mr. Hirst in *B.A.A.*, xviii., No. 4 (4½-inch, 14 pairs); and by the late Mr. J. Scott (5-inch), Shanghai. These measures of 110 pairs, ranging from 1" to 20" separation, form Mr. Scott's last work. He died on his journey home, 1908 January.

The most important series of measures is in the "Catalogue and Re-measurement of 648 Double Stars discovered by Professor G. W. Hough." This forms part iii., vol. iii., of the Publications of the University of Pennsylvania, and is the result of measures from 1901 by Dr. Doolittle, at the Flower Observatory. In addition to his own measures, Dr. Doolittle gives all published measures for each pair—a work very much needed.

Mr. Espin contributes 57 new pairs, separation 3" to 40", in *M.N.*, May, and Dr. Aitken has continued his systematic search for new double stars. By the addition of 200 (Nos. 1701 to 1900) he has outstripped all living double star discoverers. He hopes to complete his work in another two years.

An unusually large number of orbits have been computed during the year. The number given in brackets is the period deduced. In *A.N.* 4260, E. Schoenberg gives orbital elements for β 581 (33.6), β 612 (34.2), and 8 Sextantis (72.8).

Dr. See publishes elements for β 80 (63.5), β 513 (53.0), and β 552 (56.0) in *M.N.*, 1908 January, and for ξ Bootis (143.0), Σ 483 (135.5), Σ 3123 (103.3), Dembowski 15 (96.0), Secchi 2 (16.0), Σ 2 (166.0), β 581 (41.2), Σ 2438 (233), β 524 (36), 8 Sextantis (68.8), χ Velorum (10.0), and β 883 (16.6) in *M.N.*, June.

The orbit of β 416 (41.5) by J. Voûte is also in *M.N.* June, and Dr. Doberck has an orbit of γ Virginis (182.3) in *A.N.* 4235. The latter has a note on θ Orionis in *A.N.* 4270; and in *A.N.* 4229, in a paper "On the Accuracy of Measurement by the Principal Double Star Observers," he shows that errors of measurement are of a very small order (not greater than 0".05), and he also brings out the interesting fact that the error *increases* with separation.

Dr. Aitken has an orbit, with very small residuals, in *L.O.B.* 141 of β 612 (34.4); and a note by Mr. Innes in *Observatory*, No. 398, indicates that the star Lacaille 7194 will be a short-period binary. In *M.N.* (Suppl. No.) Professor Barnard gives the

history of the system Krueger 60, and from his fine series of measures shows that the close pair is a short-period binary, and that the parallax is $0''.249$.

In *M.N.*, June, Dr. See, in a paper on the "Comparative Eccentricities of Visual and Spectroscopic Binaries," shows that the average eccentricity among visual binaries is more than twice that among spectroscopic.

Dr. Abetti, in *A.N.* 4270, gives the parallax of 61^1 Cygni as $0''.24$, and of 61^2 Cygni as $0''.22$; and in *A.N.* 4250 Professor G. Comstock is able to reconcile, *inter se*, the measures of the small stars near 70 Ophiuchi by assuming the masses of the two components equal.

A series of articles by Mr. Lewis have appeared in several numbers of the *Observatory*, on the history of double star work, the computation of orbits, and on formulæ connected with orbital planes, masses, parallax, magnitudes, etc. The editors are issuing the collected articles in a small book.

One of the most important works of the year is *Publikationen des Astrophysikalischen Observatoriums zu Potsdam*. This volume by Dr. Lohse is divided into two parts:—

1. The measures made by Dr. Lohse with the 11-inch refractor during the years 1899 to 1907.
2. Computation of orbits.

Dr. Lohse measured 166 selected pairs, and, where possible, he has also collected previous measures and deduced orbits. Altogether he computes twenty-nine orbits:— β 524 (27.3), β 883 (17.0), β 621 (34.4), ξ Bootis (159.5), Σ 3062 (114.2), η Cassiopeiæ (345.6), Sirius (49.3), Castor (297.5), γ Argus (23.5), Σ 3121 (35.1), $O\Sigma$ 235 (69.7), γ Virginis (177.8), α Centauri (78.8), ξ Bootis (170.6), η Coronæ (40.6), μ_2 Bootis (244.4), ξ Scorpii (44.7), λ Ophiuchi, (123.2), Σ 2107 (134.6), Σ 2173 (45.7), μ_1 Hercules (44.7), 70 Ophiuchi (87.9), 99 Hercules (53.5), β 648 (50.9), $O\Sigma$ 387 (90), β 151 (27.0), τ Cygni (48.5), and κ Pegasi (11.2). There is a review in *Observatory*, No. 405. T. L.

Variable Stars.

The discovery of new variable stars seems to have gone on in 1908 at about the same rate as in the preceding year, the latest provisional designation given in the *A.N.* for 1908 being No. 171. Harvard College Observatory, as before, is responsible for a large proportion of these. In *H.C.O. Circulars*, Nos. 135, 137, 139, and 140 to 143, no less than 152 new variables are announced. Of this number 148 form part of the 171 just referred to.

Dr. J. Hartmann finds that the spectrum of the celebrated Nova Persei 1901 changed to the nebular condition towards the end of 1902, while in 1906 it changed again to that of the Wolf-Rayet stars. Professor E. E. Barnard has observed that changes in